GOA Trial Site Report

Canola nutrition – Optimising canola phosphorus nutrition under high nitrogen strategies

Trial Code: GONU00717-3

Season/Year: Autumn 2017

Location: 'Inglewood', Gilgandra

Collaborators: Tex and John Kilby

Keywords

GONU00717-2, canola nutrition, nitrogen, phosphorous, Gilgandra

Editor's Note

This trial evolved from the GOA's nutrition research where canola was found to be highly responsive to nitrogen (N). It was designed to test whether phosphorous (P) may become limiting when using higher rates of nitrogen to push yield potential. The 2017 season was a low rainfall year and therefore, did not meet the objective of pushing canola yield potential.

This site was drought effected. In some plots there was not enough grain for testing, and while the analysis was completed the data is not as robust as other trials with a full dataset.

Take home messages

Canola is very responsive to P, and low P levels may be more limiting to yield than low N.

Soil testing is a useful tool to test for yield limiting nutrients.

Background

Average farm area planted to canola in Central NSW has roughly doubled over the past 10 years[1], as its profitability has improved (with improved prices and bonuses for specific varieties) and because of its good fit as a cereal break crop.

There is a greater tendency to move toward a continuous cropping system. Reliance on inherent soil fertility to drive yields is potentially becoming limiting. Trials looking at phosphorous response in canola have been variable. For example, canola VSAP trials in Nyngan 2014, showed a response to added P, while no response at Trangie[2] in the same year. GOA (and other) research has shown that canola is highly responsive to added nitrogen.

It is logical that increasing canola productivity through the addition of one deficient nutrient, would also increase the demand for other deficient nutrients. This trial seeks to determine if there is such a relationship between nitrogen and phosphorous and the implications for canola management.

[1] AGSURF Data (apps.daff.gov.au/AGSURF/agsurf.asp

[2] grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2014/02/canola-agronomy-research-in-central-west-nsw

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Aim

- To determine if increasing nitrogen rates in canola require corresponding increases in phosphorous rates.

Methods

To investigate the influence of phosphorous and nitrogen rates on canola yields a matrix of 4 rates for each nutrient was devised and paired with each other.

1. Nitrogen at four rates (0, 50, 100, and 200 kg N/ha) as urea
2. Phosphorous at four rates (0, 15, 30, 45 kg P/ha) as triphos

A randomised complete block design with 3 replications across 6 ranges was designed. Results were analysed by ANOVA and results compared by using a LSD method with a 95% confidence interval. Any references to differences between treatments should be assumed statistically different unless otherwise stated.

Table 1. Trial site details

Trial Establishment Date	Autumn 2017	**Seeding rate**	2.5 kg/ha
Crop and Variety	Canola – BONITO	**Harvest Date**	23/11/2017
Sowing date	27/4/2017	**Row Spacing**	27.5 cm
Seedling equipment	Double Boot Tyne	**Soil type**	Sandy Clay Loam
Nitrogen	0-10 cm: ~19 kg/ha 10-60 cm: ~24 kg/ha	**Pre-sowing stubble Management**	Burnt stubble
Colwell P	0-10 cm: 21 ppm 10-30 cm: 8 ppm	**Previous Crop**	Wheat

Results

Plant count

Plant establishment was visually assessed by plant counts. There was no significant impact as a result of any of the fertiliser treatments.

Vegetation index (NDVI)

Vegetation index was determined using a handheld Trimble “Greenseeker” 82 days after sowing. There was no statistical difference between Nil treatments and treatments with added N or P.

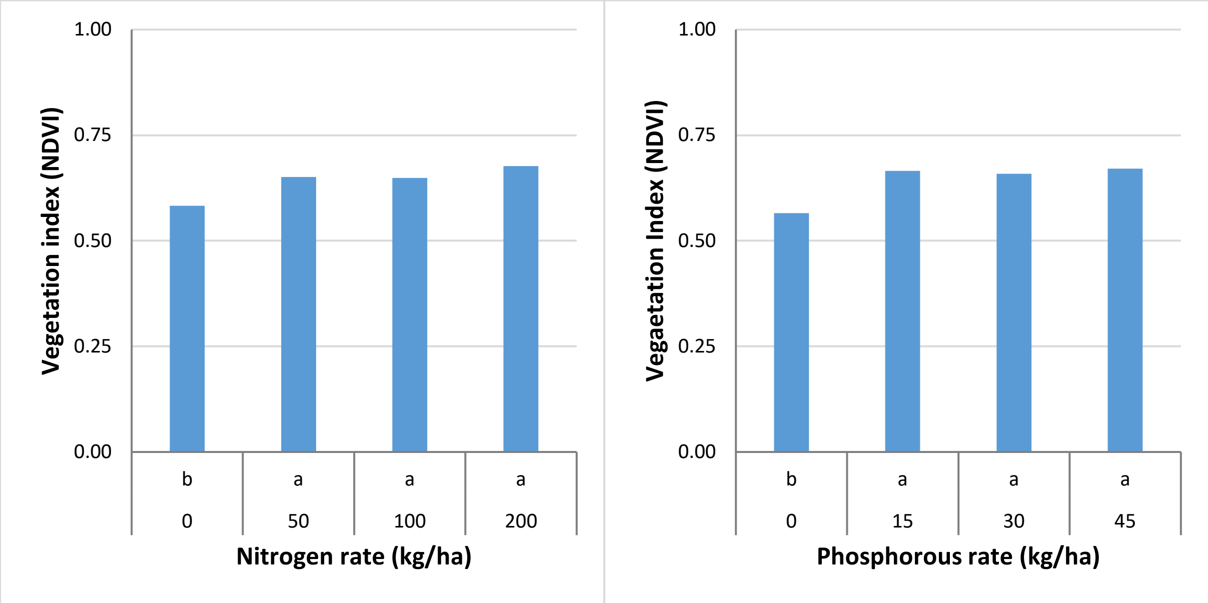

Figure 1. Canola vegetation index response to increasing rates of nitrogen and phosphorous fertilisers.

Yields

Yield increased only with P addition (regardless of the rate of nitrogen) with increasing yield as P rated increased to 45 kg/ha (

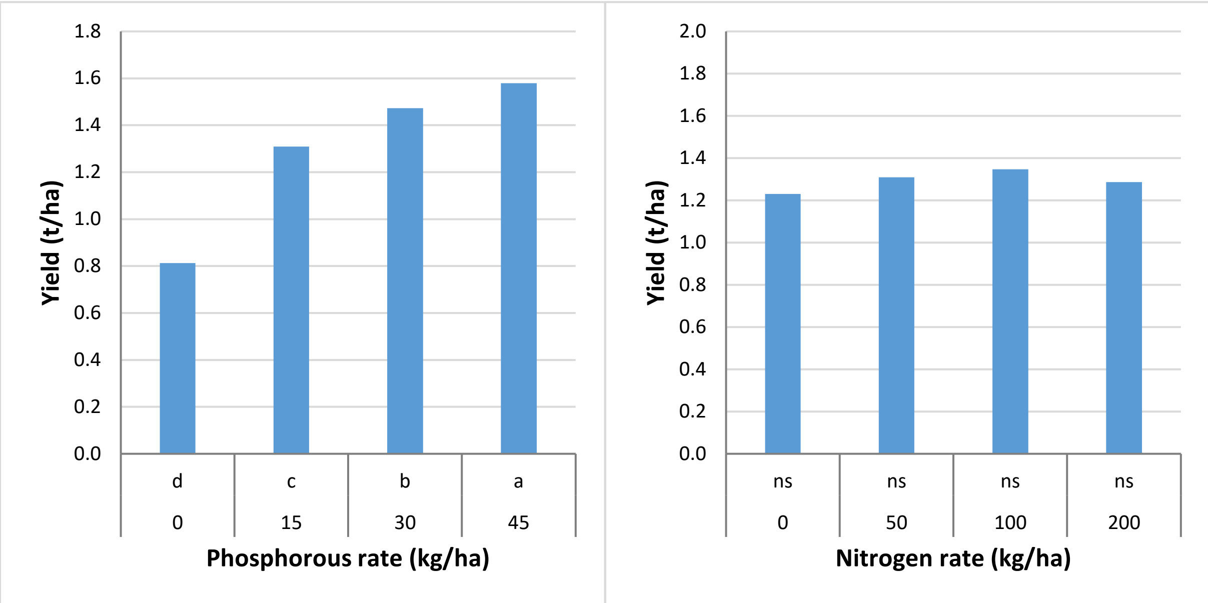

Figure 2). The was no N response.

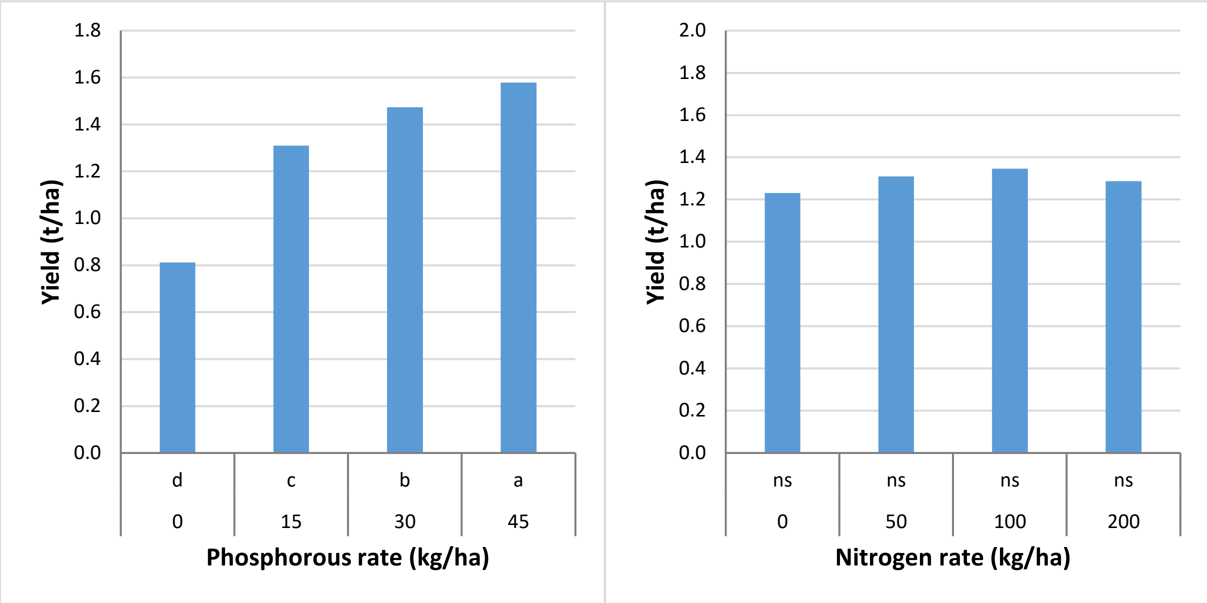

Figure 2. Canola yield (t/ha) response to increasing rates of nitrogen and phosphorous fertilisers.

There was no significant interaction between N and P rates on yields, meaning that yield responded similarly to one nutrient regardless of the rate of the other nutrient **Figure 3** (below).

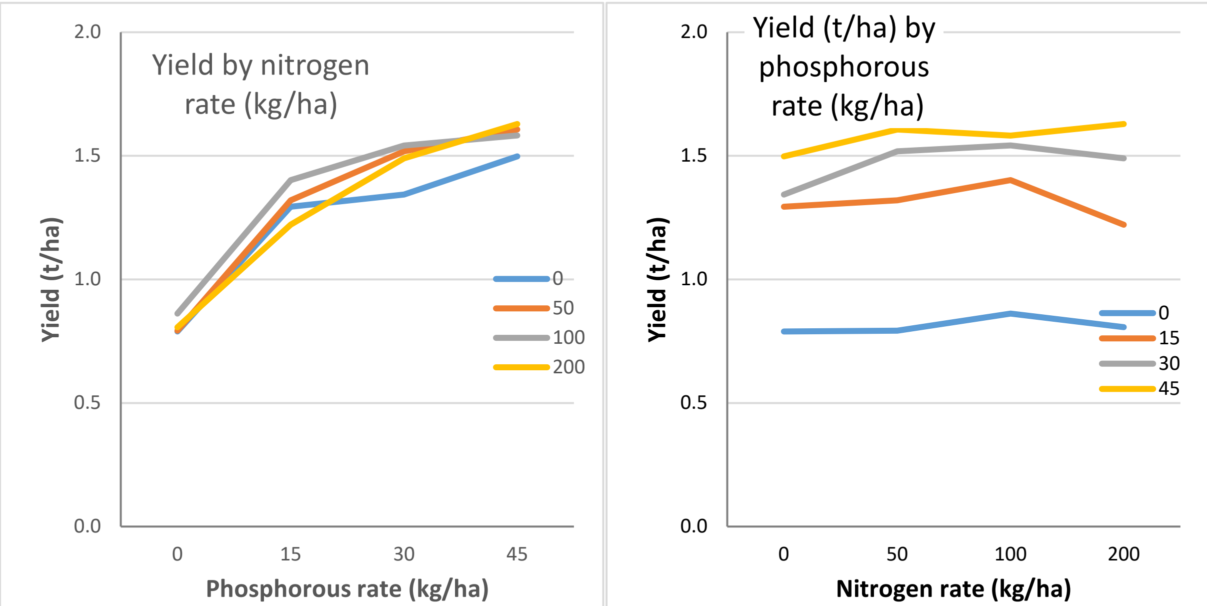

Figure 3. Canola yield (t/ha) response interaction to increasing rates of nitrogen and phosphorous fertilisers.

<u>Oil</u>

Canola oil content decreased with increasing rates of both P and N, however there was no interaction. 45 kg/ha P decreased oil by 0.8% while the difference between no added nitrogen and 200 kg/ha N was oil reduction of 1.8% (**Figure 4**).

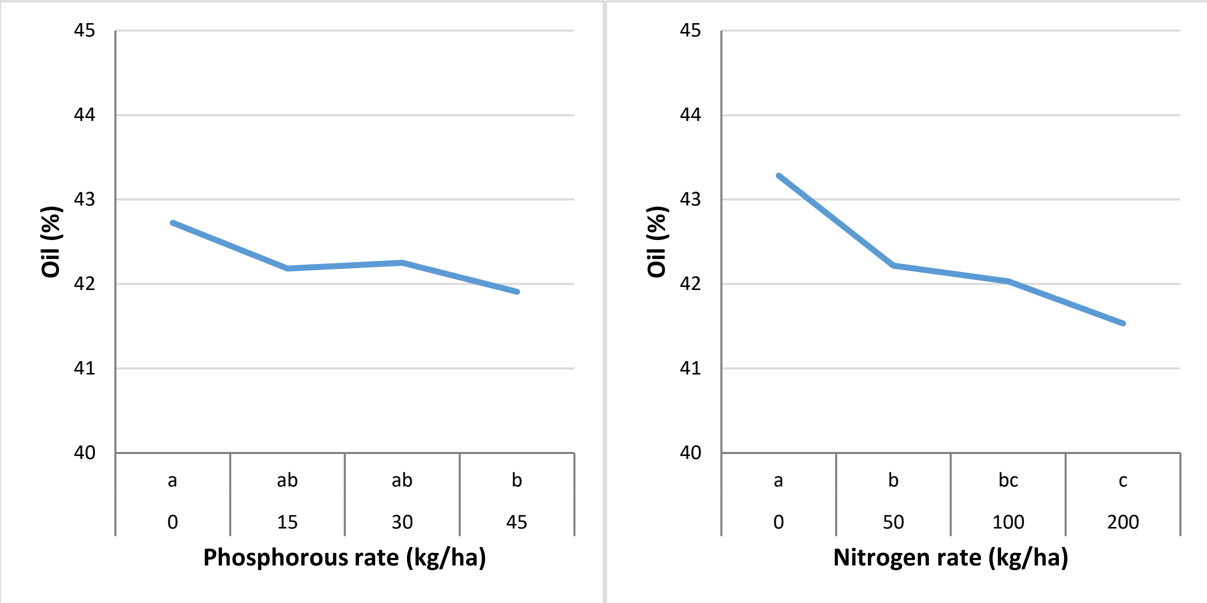

Figure 4. Canola yield (t/ha) response interaction to increasing rates of nitrogen and phosphorous fertilisers.

Discussion

Because of the dry/drought seasonal conditions in 2017 this trial did not meet the objective of determining if P may become limiting where yield potential is being pushed by higher rates of nitrogen.

Soil testing suggested the site was relatively low in both P and N. The relatively large yield response to P supports this. There was no yield response to N, however differences to applied N was detected in vegetative assessments and there was a small oil reduction to increasing rates of N.

Winter of 2017 was a very dry season. Prior to planting there was good rain in March (approximately 90 mm) which contributed to stored soil moisture. Rainfall (Gilgandra) recorded at the site from planting till the beginning of October was 35.5 mm, with the largest fall less than 15 mm. Approximately 87 mm fell in October. It is highly likely that very low rainfall for the majority of the growing season was the primary reason that there was very little N yield response. However other factors, may have also contributed to lack of N response. Timing of soil testing may not have captured potential N mineralization and hence not given an accurate indication of available soil N. It is also possible that placement of N fertiliser (broadcast and incorporated by sowing) may have limited yield response (surface stratification).

P was supplied as triphos and banded about 3 cm below the seed, while N was supplied as urea, spread ahead of planting and incorporated by sowing. It is possible that incorporation moved urea away from the seed and the very low growing season rainfall meant that N was limited in its availability (particularly early in the crops life) until October (positional unavailability). This may also partly explain oil decline with increasing N rate. It is possible that October rain unlocked N availability, however as this occurred well after pod set, it was too late to influence yield. Anecdotally some farmers report that increasing N decreases oil, but usually overshaded by increasing yields. These results tend to indicate that there may be some other interaction at play, which may warrant further investigations if this pattern is repeated.

It is not unusual for oil percentage to decrease with increasing yields which may explain the decreasing oil percentage with increasing P rates.

Conclusion

Lack of P can limit canola yields, and is possibly more limiting than nitrogen. Soils with low phosphorous levels are unlikely to respond to added nitrogen without addressing P first.

Further investigation of negative oil response to increasing nitrogen rates maybe warranted.

Acknowledgements

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Appendix

Table 2. Impact of plant populations, P rates and P placement on yield and % oil of canola. Results followed by the same letter are not significantly different.

P-rate (kg/ha)	N rate	Yield (t/ha)		Oil (%)	
0	**0**	0.3	**ns**	37.2	**ns**
0	50	0.2	ns	36.1	ns
0	**100**	0.3	**ns**	36.5	**ns**
0	200	0.2	ns	35.5	ns
15	**0**	0.6	**ns**	37.3	**ns**
15	50	0.6	ns	37.6	ns
15	**100**	0.7	**ns**	37.6	**ns**
15	200	0.6	ns	38.0	ns
30	**0**	0.8	**ns**	38.0	**ns**
30	50	0.8	ns	38.1	ns
30	**100**	0.9	**ns**	37.6	**ns**
30	200	0.8	ns	38.2	ns
45	0	0.9	ns	38.1	ns
45	50	0.8	ns	37.8	ns
45	100	0.9	ns	37.7	ns
45	200	0.9	ns	38.0	ns
	lsd	ns			